Introduction to
IDEM's Draft Pilot Program Guidance for Vapor Intrusion

INDIANA DEPARTMENT OF ENVIRONMENTAL MANAGEMENT

The IDEM Approach to Vapor Intrusion

The IDEM Pilot Program for Vapor Intrusion is a guidance document;

- **It provides a suggested approach to investigate sites to determine if the vapor intrusion pathway is complete from a source to a potential receptor.**

- **It provides screening numbers for ground water, soil gas, and sub-slab soil gas for five commonly-occurring contaminants.**

- **It provides health-protective numbers for indoor air for 61 contaminants.**

The IDEM Approach to Vapor Intrusion

The IDEM vapor guidance is a "Pilot Program"

- **Groundwater, soil gas, and indoor air data will be collected and evaluated over time from affected sites.**
- **Screening levels for groundwater and soil gas may be changed based on the site-specific data.**
- **The indoor air numbers are health-based, and will not change unless the underlying toxicological data is changed.**

State & Federal Guidance Documents

Vapor Intrusion Guidance Documents:

- **EPA (November 2002),** ***Draft Guidance for Evaluating the Vapor Intrusion to Indoor Air Pathway from Groundwater and Soils*****.**
- **Updated EPA guidance is due to be released later this year.**

Other States with Vapor Intrusion Guidance Documents:

- **Alaska (2004)**
- **Minnesota (2005)**
- **New Jersey (2005, Draft)**
- **New York (2004, Draft)**
- **Ohio (2005)**
- **Pennsylvania (2002, Draft)**
- **Wisconsin (2003)**

State & Federal Guidance Documents

States with Indoor Air Guidance Documents:

- **Colorado (2004)**
- **Massachusetts (2002)**
- **New Hampshire (2000, Draft)**

Additional Vapor Intrusion Guidance:

- **Vapor Intrusion Issues at Brownfield Sites**

Produced by the ITRC (December 2003)

The IDEM Approach to Vapor Intrusion

- **The EPA (2002) vapor intrusion draft guidance lists 114 volatile compounds in their screening tables.**
  - **Based on the health-protective indoor air numbers, EPA developed "target" screening levels concentrations for ground water, deep soil gas, and shallow soil gas.**
- **IDEM's draft guidance follows EPA's basic approach.**
  - **IDEM calculated screening level concentrations for ground water, soil gas, and sub-slab soil gas.**

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- **IDEM vapor intrusion screening level concentrations for ground water and soil in most cases significantly exceed RISC industrial default closure levels.**

- **This means that sites with potential vapor intrusion problems will usually require remediation of soils or ground water based on RISC closure levels.**

- **Vapor intrusion investigations will not determine the need for remediation of on-site soils or ground water.**

The IDEM Approach to Vapor Intrusion

IDEM Guidance *vs*. EPA Guidance - 1

- **The EPA (2002) vapor intrusion draft guidance lists 114 volatile compounds in their screening tables.**
- **IDEM's draft guidance focuses on five chemicals of concern (COCs) based on occurrence and toxicity:**
  - **Benzene**
  - **Tetrachloroethene (PCE)**
  - **Trichloroethene (TCE)**
  - **1,2 Dichloroethane (1,2-DCA)**
  - **Vinyl Chloride**

The IDEM Approach to Vapor Intrusion

IDEM Guidance *vs*. EPA Guidance – 1

- **IDEM has developed soil, groundwater, soil gas, and sub-slab gas screening numbers for these five compounds.**

- **Although screening levels were developed for only five contaminants, IDEM has health-protective indoor air numbers for 61 compounds (about half of the EPA list).**

- **Groundwater, soil gas, or sub-slab gas screening numbers can be calculated for these additional compounds as needed.**

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IDEM Guidance *vs*. EPA Guidance - 2

- **The EPA (2002) vapor intrusion draft guidance screening level numbers are for residential properties.**
- **IDEM's draft guidance has similar screening level numbers, for both residential and commercial settings.**
- **IDEM's commercial screening levels are 2.1 to 6.6 times higher than the residential screening levels, depending on the contaminant.**

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Appendix VIII – Tables

Table 1
Screening Levels for Benzene

Ground Water Screening Levels for Benzene (µg/l)

Residential

Residential Short Term		Depth to Ground Water 5ft	10ft	15ft
Soil Type	Sand	95	100	120
	Loamy Sand	200	220	230
	Sandy Loam	490	500	520
	Loam	790	820	850

Commercial

Commercial Short Term		Depth to Ground Water 5ft	10ft	15ft
Soil Type	Sand	300	340	400
	Loamy Sand	670	700	740
	Sandy Loam	1600	1600	1700
	Loam	2600	2700	2800

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IDEM Guidance *vs*. EPA Guidance - 3

- **The EPA (2002) vapor intrusion draft guidance screening numbers are based on chronic (30 year) exposure.**

- **IDEM's draft guidance for chlorinated contaminants (TCE, PCE, 1,2-DCA and VC) are based on 1, 5, 10, 20, or 30 year exposure periods.**

- **This means that if you know the exposure is less than 30 years, a higher screening level can be applied.**

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IDEM Guidance *vs*. EPA Guidance - 4

- **The EPA (2002) vapor intrusion draft guidance has a single screening number for ground water for each constituent.**
- **IDEM's draft guidance has a series of groundwater screening numbers based on depth to ground water and soil type.**
- **This means that screening levels can be applied based on known site conditions.**
- **For example, deeper groundwater levels have higher screening numbers.**

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Appendix VIII – Tables

Table 4

Residential Ground Water Screening Levels

Compou

Tetrachloroethylene (PCE) | **Trichloroethylene (TCE)**

1 Year

PCE 1 Year		Depth to Ground Water 5ft	10ft	15ft
Soil Type	Sand	120	130	160
	Loamy Sand	260	270	290
	Sandy Loam	630	640	660
	Loam	1000	1100	1100

TCE 1 Year		Depth to Ground Water 5ft	10ft	15ft
Soil Type	Sand	77	84	99
	Loamy Sand	170	180	190
	Sandy Loam	400	410	420
	Loam	650	680	700

5 Year

PCE 5 Year		Depth to Ground Water 5ft	10ft	15ft
Soil Type	Sand	23	25	30
	Loamy Sand	51	53	56
	Sandy Loam	120	120	130
	Loam	200	200	210

TCE 5 Year		Depth to Ground Water 5ft	10ft	15ft
Soil Type	Sand	16	17	20
	Loamy Sand	35	36	38
	Sandy Loam	82	84	86
	Loam	130	140	140

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IDEM's draft guidance is divided into two parts, based on the contaminants:

Part A, BTEX Sites:

The primary contaminant is Benzene

Part B, Chlorinated Sites:

Tetrachloroethene (PCE)

Trichloroethene (TCE)

1,2 Dichloroethane (1,2-DCA)

Vinyl Chloride

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BTEX Sites - Background Information:

- **Relative to many environmental contaminants, petroleum releases into the environment are generally well behaved:**

- **Liquid petroleum floats on the water table making it easier to find and recover.**

- **Petroleum releases are generally biodegradable in aerobic environments (at least the lighter fractions).**

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Therefore;

- **Groundwater plumes from petroleum releases tend to be short,**

- **Areas of potential vapor intrusion are typically smaller, and adjacent to the site,**

- **Petroleum releases tend to be more easily managed.**

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Chlorinated Sites - Background Information:

- **Chlorinated solvent releases are generally not very biodegradable in aerobic subsurface environments.**

- **High density and low viscosity = high mobility in the subsurface.**

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Therefore;

•Groundwater plumes can be very long, depending on the geologic environment,

•Areas of potential vapor intrusion may be large, and extend a considerable distance from a site,

• Chlorinated solvent releases can be very complex, and not easily managed.

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IDEM's draft guidance is divided into two parts, based on the COCs:

Part A, BTEX Sites:

- **The primary COC is Benzene**
- **The exposure duration is assumed to be fixed at 5 years.**
- **Longer exposure will require a "non-default" evaluation.**

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IDEM's draft guidance is divided into two parts, based on the COCs:

Part B, Chlorinated Sites:

- **COCs include PCE; TCE; 1,2-DCA; and VC.**
- **Screening levels are based on exposure duration.**
- **Screening levels have been developed for 1, 5, 10, 20, and 30 years exposure.**
- **This approach requires an estimate be made of the likely time of exposure, but provides higher screening levels for shorter term exposures.**

The IDEM Approach to Vapor Intrusion

- **The IDEM guidance is intended to establish whether a pathway exists between a source (contaminated soil or groundwater), and a potential receptor (indoor air) using a sequential investigation approach.**

The IDEM Approach to Vapor Intrusion

Establish the pathway:

- **Site-specific soil and groundwater data are compared to the appropriate soil and groundwater screening levels in the guidance.**

- **If those screening levels are exceeded, then soil gas or sub-slab vapor samples are collected and compared to the soil gas and sub-slab screening levels.**

- **If soil gas or sub slab samples exceed screening levels, then indoor air samples are collected.**

The IDEM Approach to Vapor Intrusion

One exception to the sequential approach:

If soil or groundwater concentrations are more than ten times higher than screening levels, IDEM recommends prompt, simultaneous sampling of soil or sub-slab gas AND indoor air.

This allows a more rapid evaluation of potential exposure.

EPA (2002) uses a multiplier of 50 times, however, the EPA screening numbers are much lower to begin with.

The IDEM Approach to Vapor Intrusion

When do you not use this guidance?

- If immediate threats exist (fire, explosive atmosphere, etc.)
- If there are noticeable petroleum or solvent odors. If odors are present, sample indoor air promptly.
- If contaminated groundwater is present within five feet of a structure, beneath a basement or slab.
- Significant preferential pathways exist connecting a source area with a structure (sewer lines, utility conduits, etc.)

The IDEM Approach to Vapor Intrusion

Establish the pathway:

Preliminary Screening;

Evaluate the site for;

•COCs in soil and groundwater,

•Vulnerabilities such as shallow groundwater or preferential pathways,

•Occupied structures within 50 feet of a soil or groundwater source for BTEX sites.

•Occupied structures within 100 feet of a soil or groundwater source for chlorinated sites.

The IDEM Approach to Vapor Intrusion

Establish the pathway:

Step 1-Soil and Groundwater Screening;

- **Compare your site soil and groundwater data to IDEM's screening levels (residential or commercial):**

- **If a contaminant concentration in groundwater exceeds the screening level, soil gas or sub-slab vapor sampling is warranted.**

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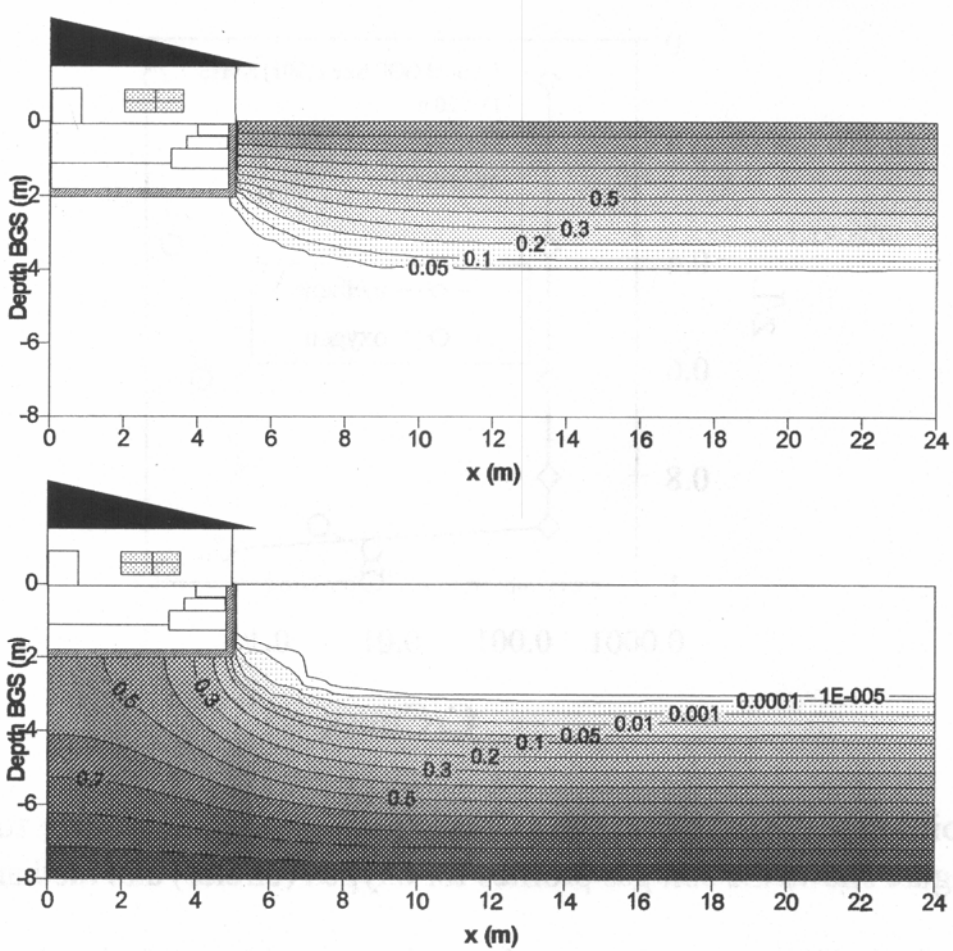
Establish the pathway:

Step 2: Soil Gas or Sub-Slab Vapor Screening;

- **If a site has failed soil or groundwater screening, some form of soil gas evaluation is warranted.**

- **Soil gas samples can be collected outside the footprint of nearby structures or sub-slab vapor samples can be collected from directly beneath a structure.**

- **Sub-slab sampling is preferred by IDEM.**



Numerical simulation showing Oxygen (top) and BTEX (bottom) vapor profiles beneath a structure.

Source: American Petroleum Institute, October 2004

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Establish the pathway:

Step 2: Sub-Slab Vapor Screening;

- **Sub-slab sampling is more difficult and intrusive, and requires the cooperation of the building owner.**

- **Sub-slab sampling techniques are based on EPA guidance.**

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Establish the pathway:

Step 2: Soil Vapor Screening;

- **If sub-slab samples cannot be collected, then soil gas samples are collected.**
- **Soil gas samples should be collected from the upgradient and downgradient sides of a potentially affected building.**
- **Multi-depth samples should be collected:**
  - **Several feet above the water table.**
  - **Five feet below the base of the building.**

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Establish the pathway:
Step 3: Indoor Air Evaluation;

- **If soil gas or sub-slab sample results exceed screening levels, then indoor air sampling is warranted.**

- **Indoor air is typically sampled last because of problems with "background" contaminants.**

- **Background contaminants may be found in indoor air due to use of common household products that contain chemicals.**

- **Examples include benzene from smoking, stored fuel, or cars parked in attached garages.**

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Establish the pathway:

Step 3: Indoor Air Evaluation;

- **If indoor air sample results exceed the action levels then the pathway is complete.**

- **Prompt action is necessary to reduce exposure.**

- **Exposure prevention in documented vapor intrusion cases will often be accomplished by installation of a sub-slab depressurization system (a radon system).**

The IDEM Approach to Vapor Intrusion
Summary

IDEM's draft vapor intrusion guidance is intended to provide a flexible approach for evaluating sites for vapor intrusion.

- **Screening numbers were developed for commercial and residential sites.**
- **Screening numbers for chlorinated compounds were developed for different exposure durations (1, 5, 10, 20 and 30 years).**
- **Screening numbers for groundwater were developed based on depth to groundwater and soil types.**

The IDEM Approach to Vapor Intrusion

Summary

- **Screening levels were developed for five commonly-occurring contaminants (Benzene, PCE, TCE, 1,2-DCA, and vinyl chloride).**

- **Health-protective indoor air numbers are available for a total of 61 compounds.**

The IDEM Approach to Vapor Intrusion

Summary

The IDEM approach is to establish whether a pathway exists between a source area and a potential receptor using a sequential investigation approach.

- **First, screen soil and groundwater concentrations;**
- **Second, collect soil gas or sub-slab soil vapor samples, if necessary,**
- **Finally, sample indoor air, if necessary.**

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To obtain a copy of the IDEM Draft Vapor Intrusion Guidance document, email;

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A PDF copy of the document will be sent to you.